FIG. 1

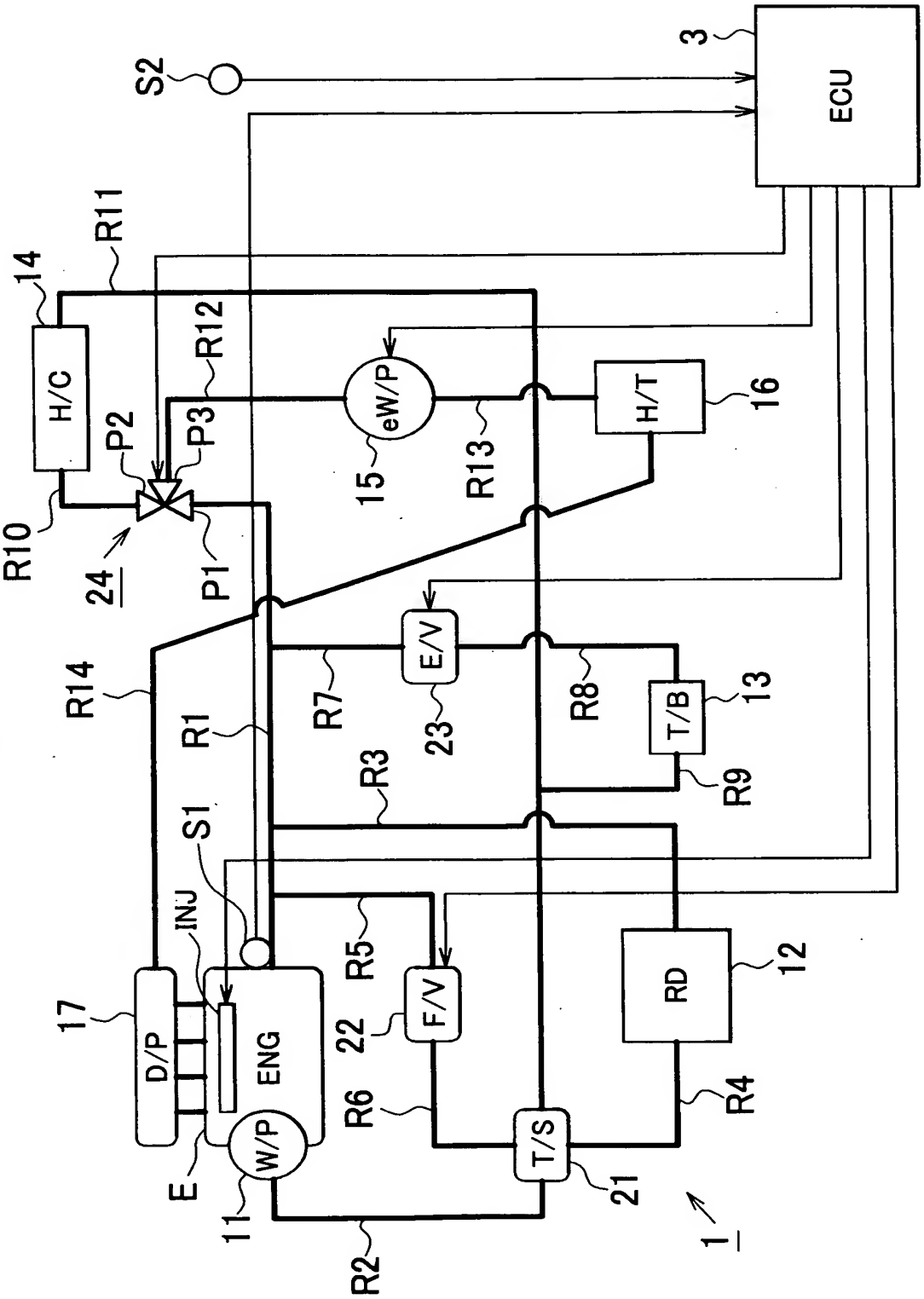

ECU
3
S2
H/C
14
R11
R12
P2
P3
P1
R10
24
eW/P
15
R13
H/T
16
E/V
23
R7
R8
T/B
13
R9
R14
R1
R3
S1
INJ
D/P
17
ENG
W/P
E
11
R2
R5
F/V
22
R6
T/S
21
RD
12
R4
1

FIG. 2

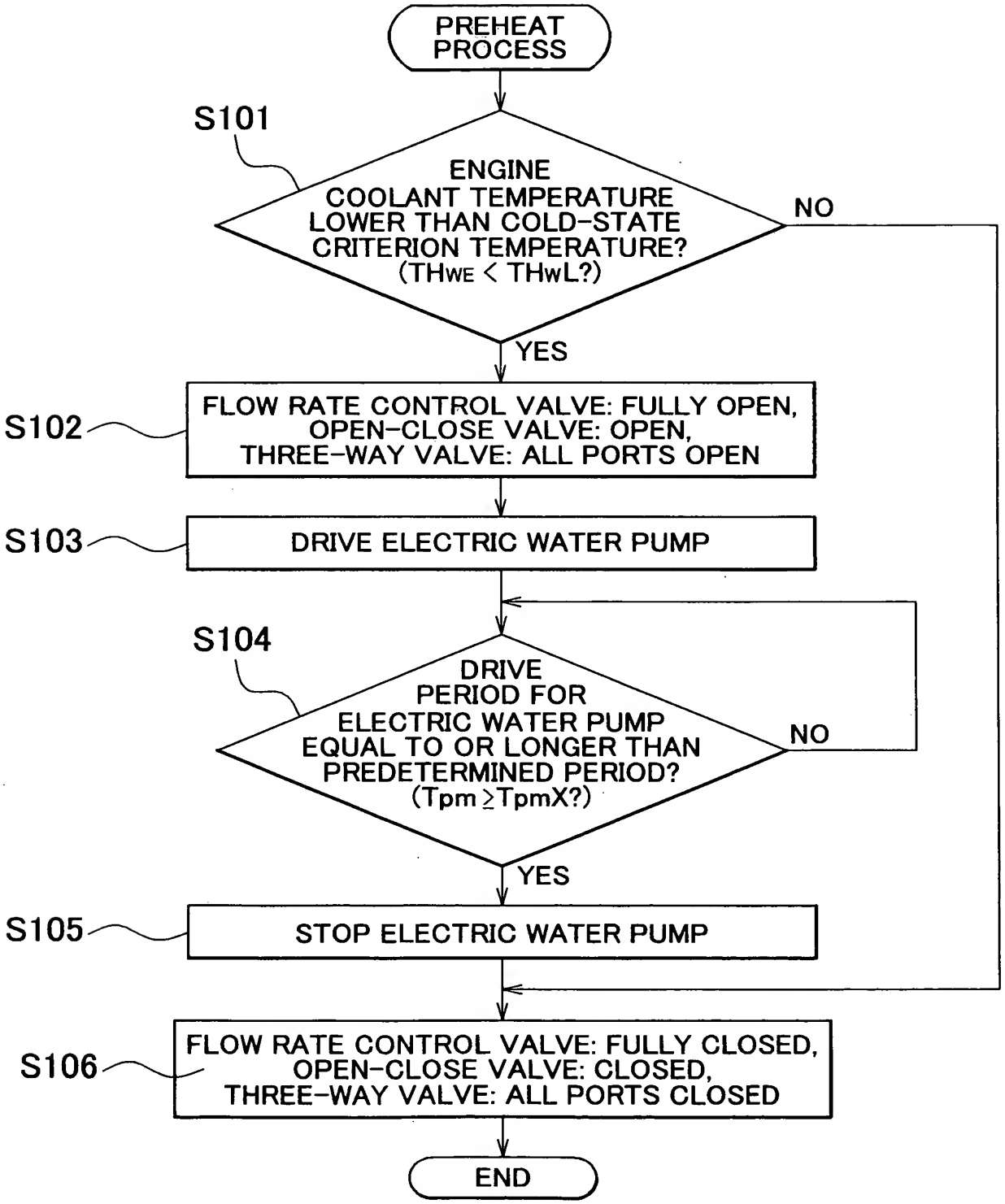
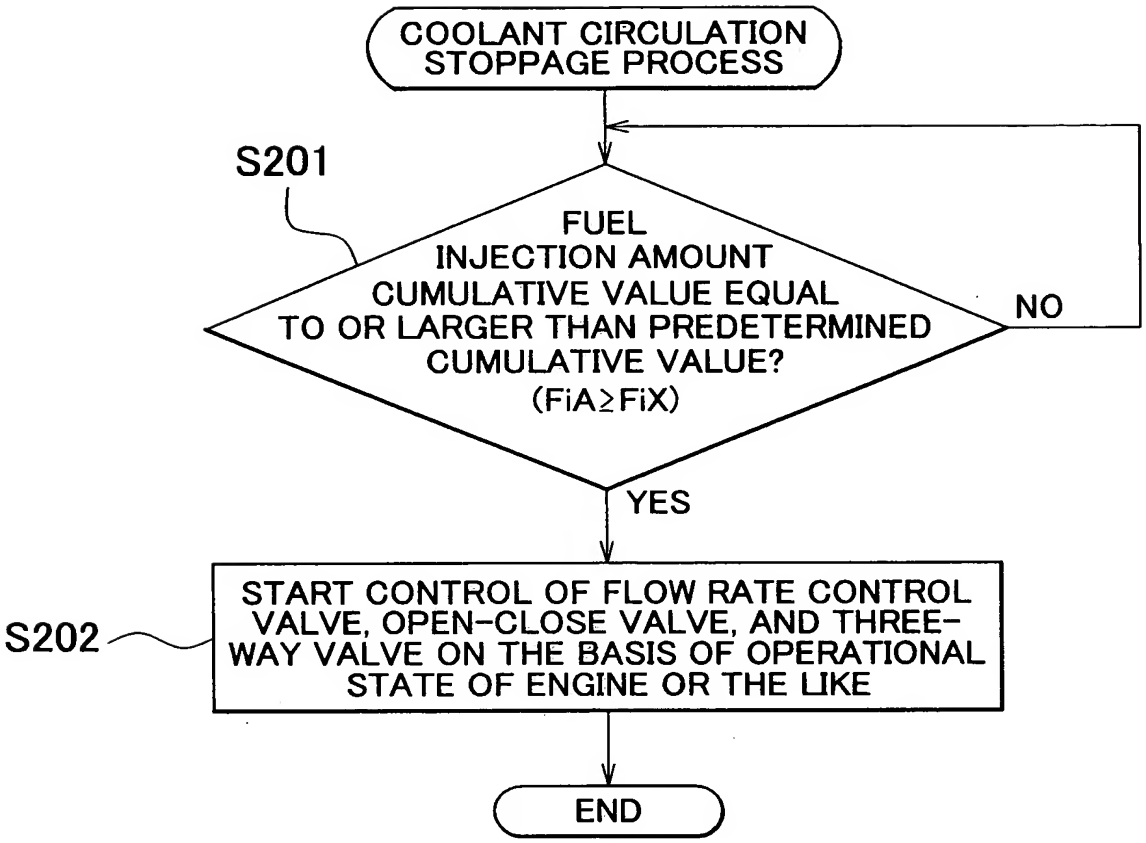

PREHEAT PROCESS
S101
ENGINE COOLANT TEMPERATURE LOWER THAN COLD-STATE CRITERION TEMPERATURE? (THWE < THWL?)
NO
YES
S102
FLOW RATE CONTROL VALVE: FULLY OPEN, OPEN-CLOSE VALVE: OPEN, THREE-WAY VALVE: ALL PORTS OPEN
S103
DRIVE ELECTRIC WATER PUMP
S104
DRIVE PERIOD FOR ELECTRIC WATER PUMP EQUAL TO OR LONGER THAN PREDETERMINED PERIOD? (Tpm ≥ TpmX?)
NO
YES
S105
STOP ELECTRIC WATER PUMP
S106
FLOW RATE CONTROL VALVE: FULLY CLOSED, OPEN-CLOSE VALVE: CLOSED, THREE-WAY VALVE: ALL PORTS CLOSED
END

FIG. 3


COOLANT CIRCULATION STOPPAGE PROCESS
S201
FUEL INJECTION AMOUNT CUMULATIVE VALUE EQUAL TO OR LARGER THAN PREDETERMINED CUMULATIVE VALUE? (FiA≥FiX)
NO
YES
S202
START CONTROL OF FLOW RATE CONTROL VALVE, OPEN-CLOSE VALVE, AND THREE-WAY VALVE ON THE BASIS OF OPERATIONAL STATE OF ENGINE OR THE LIKE
END

# FIG. 4

ENGINE CONTROL DEVICE CONTROL PATTERN

| | ELECTRIC WATER PUMP | FLOW RATE CONTROL VALVE | OPEN-CLOSE VALVE | THREE-WAY VALVE | THERMOSTAT |
|---|---|---|---|---|---|
| WHEN ENGINE IS STARTED IN COLD STATE (PREHEAT HAS NOT BEEN COMPLETED) | DRIVEN | FULLY OPEN | OPEN | ALL PORTS OPEN (HEATER PASSAGE/ HEAT-ACCUMULATING PASSAGE: OPEN) | CLOSED |
| WHEN ENGINE IS STARTED IN COLD STATE (PREHEAT HAS BEEN COMPLETED) | STOPPED | FULLY CLOSED | CLOSED | ALL PORTS CLOSED (HEATER PASSAGE/ HEAT-ACCUMULATING PASSAGE: CLOSED) | |
| WHEN ENGINE IS STARTED IN HOT STATE | | | | | |
| IMMEDIATELY AFTER ENGINE HAS BEEN STARTED (FiA < FiX) | | | | | |

FIG. 5

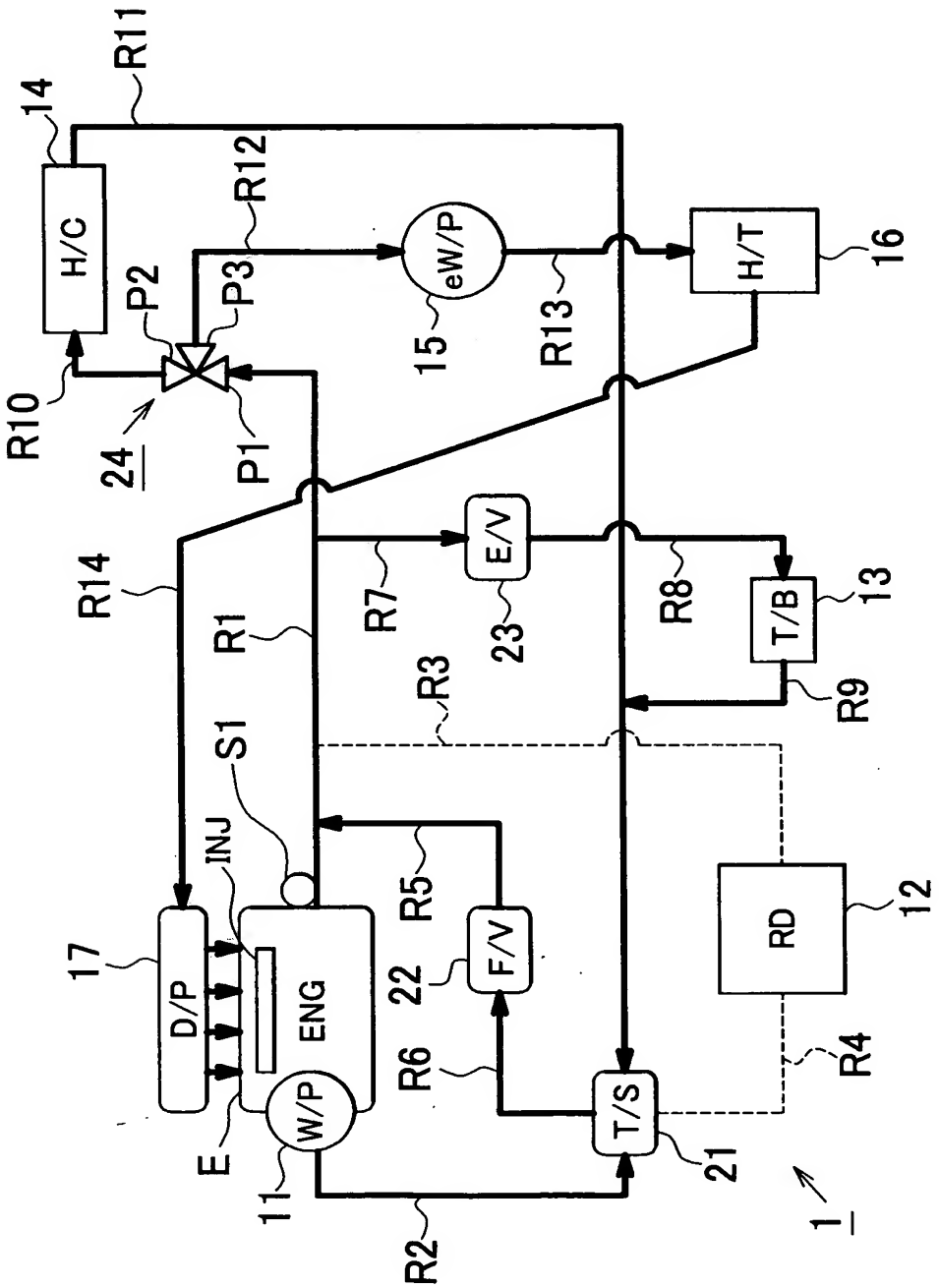

H/C
14
R11
R12
P2
P3
eW/P
15
R13
H/T
16
R10
24
P1
R14
R1
R7
E/V
23
R8
T/B
13
R9
R3
S1
INJ
R5
17
D/P
ENG
22
F/V
RD
12
R6
W/P
E
11
T/S
21
R4
R2
1

FIG. 6

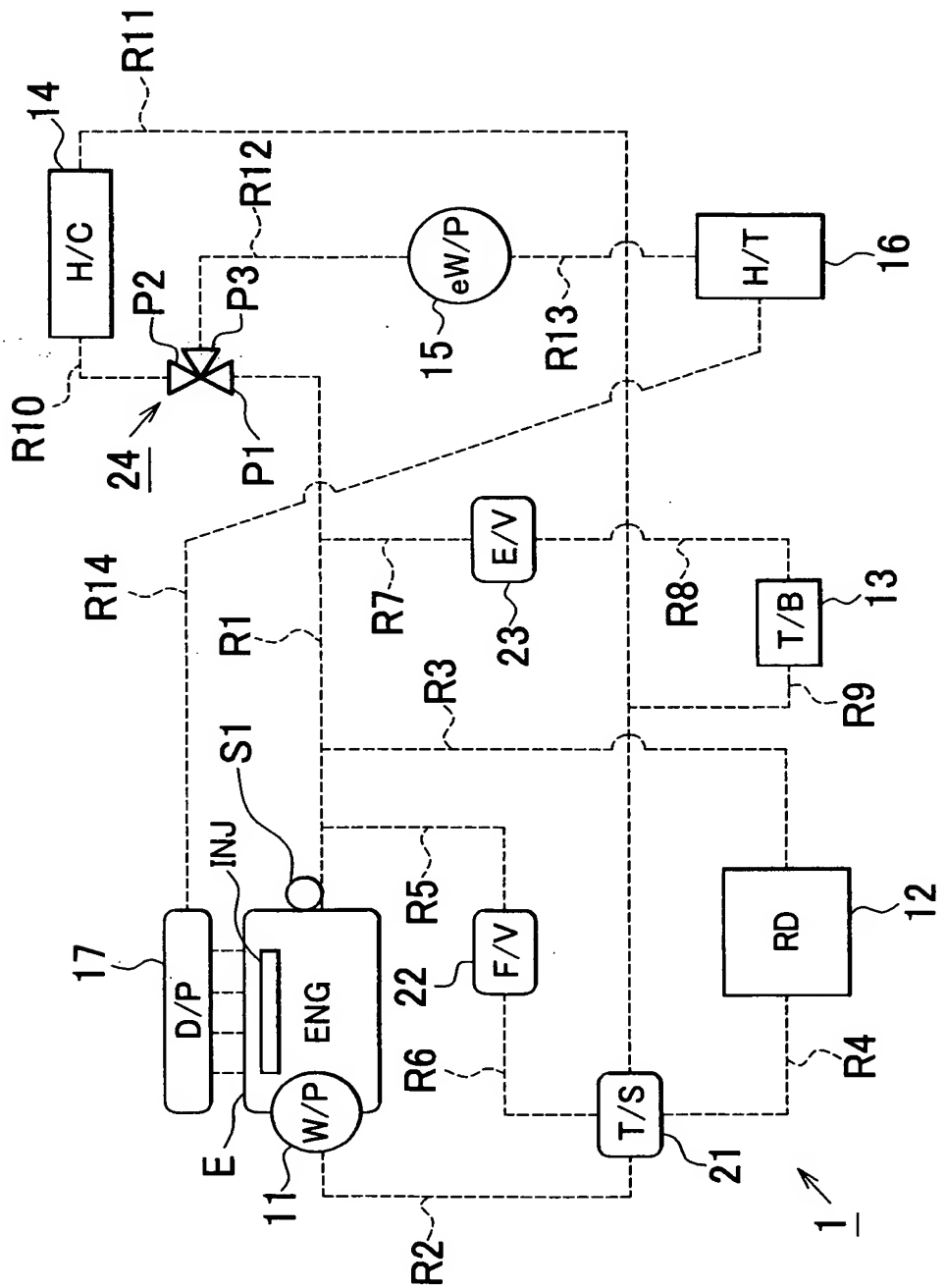

H/C
14
R11
R12
P2
P3
eW/P
15
R13
H/T
16
R10
24
P1
R14
R1
R7
E/V
23
R8
T/B
13
R3
R9
S1
INJ
R5
17
D/P
ENG
F/V
22
RD
12
R6
W/P
T/S
R4
E
11
21
R2
1

FIG. 7A
ENGINE

FIG. 7B
REQUEST TO START ENGINE

FIG. 7C
FLOW RATE CONTROL VALVE

FIG. 7D
OPEN-CLOSE VALVE

FIG. 7E
THREE-WAY VALVE

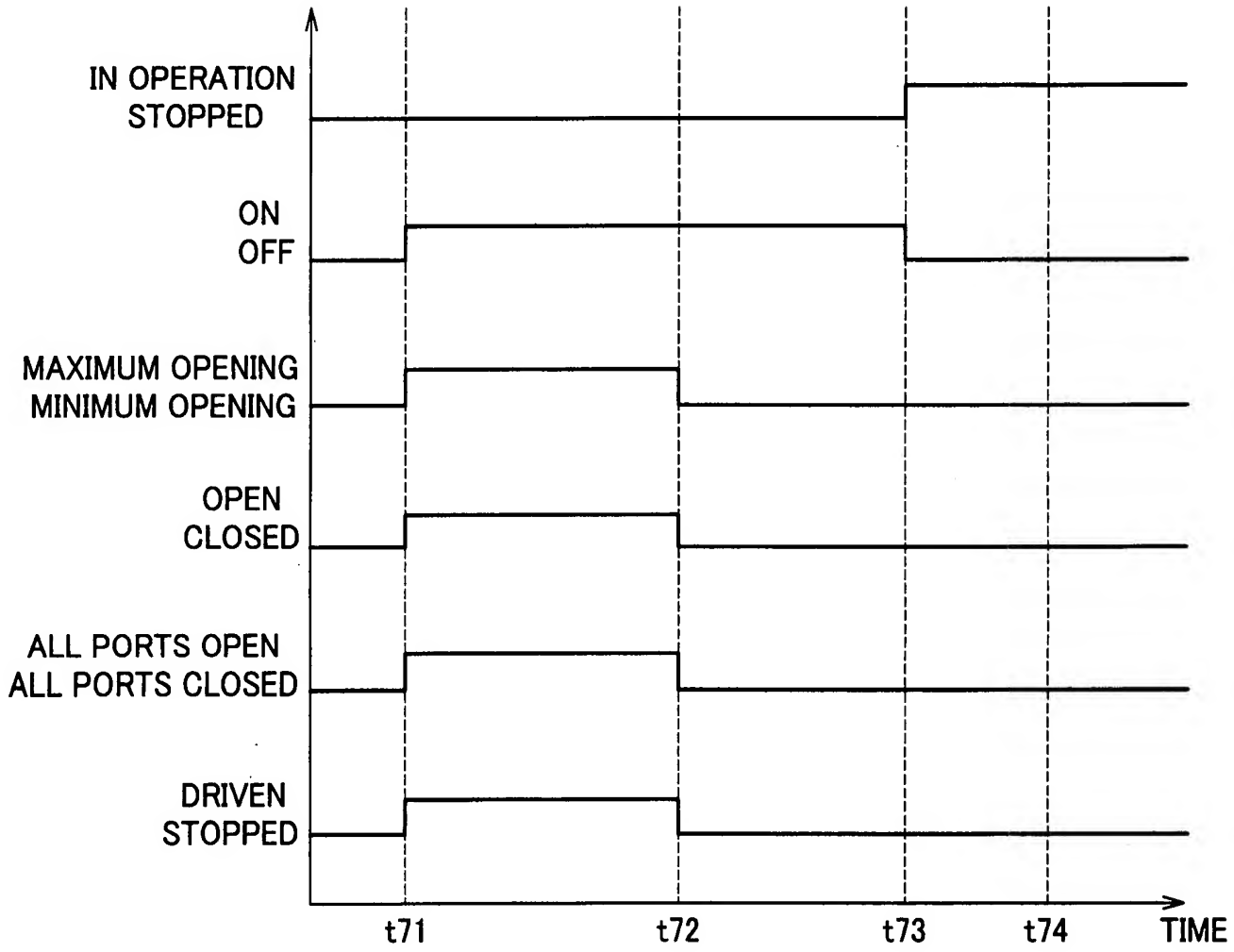



FIG. 7F
ELECTRIC WATER PUMP